

Transition from DeltaE version 4 to version 5: A note for experienced users

Version 5 introduces three major changes: a *thermally insulated mode* that replaces and improves on the older INSDUCTs and INSCONEs, the ability to set *beginning energy flux* \dot{H}_2 in the BEGIN segment, and *simpler segment names* for ducts, cones, and heat exchangers.

1. Thermally insulated mode

Version 5 introduces a new point of view to DeltaE: There is now a “thermally insulated mode” that affects segments such as IMPEDANCE, COMPLIANCE, 'DUCT, 'CONE, etc. In thermally insulated mode, such segments are considered laterally thermally insulated (just like stacks always have been), so heat can only escape via nearby heat exchanger segments. This mode is intended to match reality in most actual apparatus. For example, a typical resonator duct is generally not jacketed with cooling water, and even if it is most of the heat may go to a nearby heat exchanger via thermoacoustic heat pumping along the surface of the duct.

To appreciate this new point of view, consider a control volume drawn around any portion of a thermoacoustic apparatus that is modeled by DeltaE. In the new, thermally insulated mode, the only way energy (\dot{H}_2) can enter or exit the DeltaE model is through one of a few segments:

- BEGIN, HARDEND, SOFTEND
- one of the heat exchangers via the heat parameter,
- one of the transducers via the electric power
- into or out of a BRANCH.

One advantage of the new mode is that it allows easy insertion of COMPLIANCE or IMPEDANCE between a stack and a heat exchanger, e.g. to model a small header volume or a minor loss. In the insulated mode, \dot{H}_2 will flow across such a segment without being changed.

The new mode also causes branches to behave like the old HBRANCH, and UNION to behave like the old HUNION. It also gives SOFTEND and HARDEND

a new potential target, \dot{H}_2 , so the end of the model can be thermally "sealed" to force heat into an upstream heat exchanger (where the heat must be a guess).

DeltaE's original mode of operation still works, and users who are satisfied with the original mode of operation should notice no differences.

DeltaE begins in the old mode by default. To use the new mode, insert segment type INSULATE where you want the insulation to begin; this might often be immediately after the BEGIN segment. To return to the old mode, insert segment type CONDUCT.

2. Beginning energy flux

To set \dot{H}_2 in a BEGIN segment, simply modify parameter 0h, which has previously been invisible. This parameter becomes "starting energy flow;" enter a number. To return to the previous situation in which $\dot{H}_2 = \dot{E}_2$ in a BEGIN segment, modify 0h again and enter "Edot".

3. Simpler segment names

New segments

DUCT,

CONE,

HX, TX, SX, and PX

can be used instead of the old segments

INSDUCT, ISODUCT,

INSCONE, ISOCONE,

HXFRST, HXMIDL, HXLAST,

TXFRST, TXMIDL, TXLAST,

SXFRST, SXMIDL, SXLAST,

PXFRST, PXMIDL, and PXLAST.

The old segments are still supported, but we hope users will enjoy the simplicity of the new segments.

In thermally insulated mode, the new ducts and cones behave as if they are insulated, and the heat exchangers use the given heat (which can be a guess) to compute their exit energy flow.

In DeltaE's original mode, the new DUCT and CONE segments act like ISODUCT and ISOCONE, and the new heat exchanger segments decide whether they should behave like 'FRST, 'MIDL, or 'LAST by looking nearby for the presence of stacks.